Between 1908 February 24 and March 29 I made numerous estimates of the sizes of the satellites. It had been intended to estimate their relative diameters, but at the latter date it was found that the eye is to a certain extent influenced by the area of the object. By experiments with coins, it was further found that the error of estimate varies with the ratio of the diameters. Of these earlier observations, it will suffice to say that the order of size found was:—J III much larger than J IV, J IV much larger than J I, J I slightly larger than J II.

After 1908 March 29 I estimated the diameters of the satellites by means of a set of discs drawn in black on white, which varied in size by tenths from 0·3 to 1·0 (unit = 2^{cms}). With these artificial discs, estimates (30 in all) were made, from 1908 April 4 to June 2, at all times that any pair of satellites were sufficiently close together. Such estimates can only yield the relative sizes of the satellites, so that it is necessary to assume the diameter of one of them is known: if we take J III as being = $1''\cdot154$, the ratios found then give

J I = 0·82. J II = 0·69. J III = 1·15. J IV = 1·03.

In comparing these figures with those given above it would seem that, if anything, the diameter of J III is still found somewhat too large.

Markings on the Satellites.

At all times J I and J II were seen as uniformly lighted round discs; J III was often strikingly deformed, and J IV was too dim to be seen clearly with the light-grasp of the 9-inch. As in the other observations, a power of 700 was always used, and I do not consider, as I have already said, that a lower power would be useful. The difference between the pretty picture of Jupiter, its cloud-belts and four bright satellites, under powers of 200–300, and a power of 700, was remarkable; with the lower powers J IV appears as a tiny sparkling point, but with 700 it was seen as a large sombre disc of a hexagonal shape, due no doubt to dark markings which were beyond the light-grasp of the telescope. With 200 magnification, J II was star-like, but with 700 its disc, though small, was quite distinctly seen. The remarkable shape of J III was first noticed on 1908 Feb. 10, and between that date and 1908 June 6 about sixty observations were made. On nights when the irregular shape, bright spot or mark on J III were well seen, sketches were made; these have been reproduced by Mr. Wesley and arranged in order of age in days from superior geocentric conjunction. Mr. Wesley must not be blamed for the inartistic appearance of my sketches, which indeed are not meant to be pretty pictures, but to represent as closely, faithfully, and without any imagination, what I actually saw. After all, J III is but a small object in a telescope. My present interpretation of the observations is that J III is round, as is proved by its shadow, in

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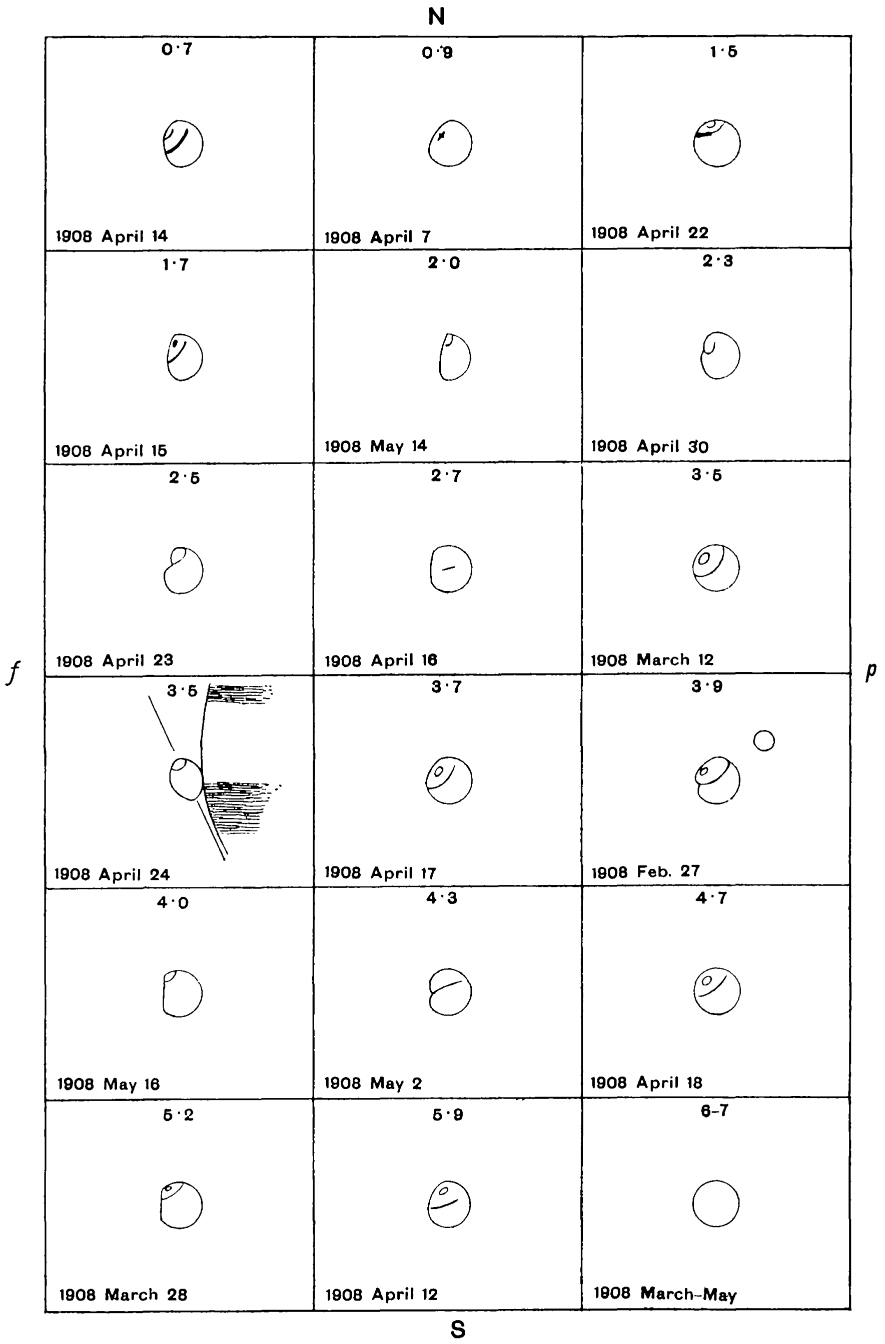

III. SATELLITE OF JUPITER.

Sketches arranged in order of days since Superior Geocentric Conjunction.

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transit, but that it has some very dark markings, which, however, are always on the following side, and do not transit its disc; that the satellite may rotate in the same time as it revolves (about 7·1 days), or it may rotate exceedingly slowly; the bright spot is not always marginal, but when it is, it is at a position-angle of about 30° from Jupiter's axis. The plausible interpretation that J III does not rotate (or does so very slowly), but has large librations, must await further and almost continuous observations.

The irregular shape of J III has often been noticed; thus Lassell (*M.N.*, x. p 113, and xvii. p. 67) says :

1850 Feb. 28. $11^h\ 48^m$ G.T. J III, oblong or irregular. (Age 5·8 days.)

Mar. 12. $11^h\ 25^m$ G.T. J III is approaching the f. limb of the planet. There is certainly a spot on the satellite's disc in the n.p. quadrant. Its disc also seems a little flattened on the f. side. (Age 3·6 days.)

1856 Oct. 5. $10^h\ 45^m$ G.T. J III and J IV seem oval. (Age 1·8 days.)

Observations of J III.

1908.

Feb. 10. 10^h G.T. J III decidedly elliptical, longest axis N. and S. Ellipticity 1 in 5. Outline irregular, is kidney-shaped. J I and J II round.

24. 7^h–9^h G.T. J III like Moon 9 days old, term. away from Jupiter—indistinct markings.

25. J III shape of Moon 8 days old.

27. J II is round; its surface is much brighter than that of J III, and about equal to the bright spot on J III's northern part. J II about equal to the N. part of J III. Whilst waiting for the conjunction of J II and J III on this evening, the irregular shape of J III attracted attention. It is most easily described as being shaped like a cottage loaf or a squat figure-of eight, the smaller flattened part being to the N. The N. end of the axis was tilted about 30° towards Jupiter. The S. part was the larger and was yellow; the N. part was bluish with a brilliant white speck, not unlike the polar cap of Mars, but it was not marginal. The sketch, necessarily rough, gives a fair idea of the appearance.

Observations after February refer to the third satellite, J III.

Mar. 5. Shadow of J III in mid-transit, is large and round; J III against sky is perhaps elongated N. and S., but definition is bad.

9. 6^h G.T. Slightly elongated N. and S. All discs clearly seen. J IV large and dim, an effect which is quite lost with a power of 120.

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1908.

Mar. 10. 6^{h} G.T. Shaped like Moon 9 days old, convexity to Jupiter; northern spot and equator band glimpsed.

11. Nearly round; it has a dark line along lat. 40°, with a bright spot within (N. hemisphere).

12. 6^{h} G.T. Round; it has a bright white spot in the N.E. quadrant with a dark line. Both before and after transit this evening, round.

13. Nearly if not quite round, spot unchanged.

15. Round, or nearly so; no certain markings.

16. Very hazy. The effect of haze on the appearance of J I, J II, and J III (but not J IV) in reducing their apparent sizes indicates that, like Jupiter, the margins are not so bright as the centres of their discs.

18. $5^{h}\ 30^{m}$ G.T. Like Moon 8 days old, convexity to Jupiter; marking and spot seem to be more crowded to the N.E. (N.f.) than usual.

19. $6^{h}\ 30^{m}$ to 8^{h} G.T. Approaching transit is oval and cottage-loaf shaped, with bright N.f. spot on N. part of disc; is tilted 20 degrees away from Jupiter.

22. All four discs remarkably well seen. $5^{h}\ 30^{m}$ G.T. Near p. elongation is round, no markings certainly seen. 9^{h} G. T. J III round.

28. $4^{h}\ 35^{m} - 6^{h}\ 35^{m}$ G.T. Nearly round, perhaps a bit cut off on side next to Jupiter; bright spot and marking are barely visible, and are close to limb at 45° (N.f.).

29. $5^{h} - 7^{h}\ 45^{m}$ G.T. Round, no markings, certainly seen; perhaps J III is just a bit brighter at 45° (viz. on N.f. limb).

30. $6^{h}\ 47^{m}$ G.T. Round; no markings certainly seen.

31. $7^{h}\ 39^{m}$ G. T. Like Moon 8 or 9 days old, with blunted horns, term. f.—*i.e.* away from Jupiter. No markings certainly seen.

April 1. $5^{h}\ 40^{m}$ G.T. Like Moon 8 days old, term. f., longer axis N. and S. to Earth's equator. Spot and mark visible by glimpses.

2. $5^{h}\ 30^{m}$ G.T. Nearly round.

3. 6^{h} G.T. Like Moon 11 days old, term. to Jupiter; spot and mark glimpsed; bad air.

4. 6^{h} G.T. Round; perhaps a bright spot on limb N.f. 45°, but quite uncertain.

6. $4^{h}\ 30^{m} - 6^{h}\ 30^{m}$ G.T. J III round.

7. 6^{h}. All but round; a dark mark encroaches at 45°. 7^{h} G.T. slightly oval, like Moon 11 days old.

8. 6^{h}. Nothing certain; round or nearly so; a dark indentation about 60°.

10. 6^{h}. Like Moon 8 days old, terminator to Jupiter.

12. 6^{h}. Very slightly oval, spot and mark seen with difficulty; the marking is nearly central.

13. 6^{h}. Round or nearly so.

1908.

April 14. $5\frac{1}{2}^{h}$. Like Moon 9 days old, term. away from Jupiter, spot and mark seen with difficulty in N.f. quadrant.

15. 5–6^{h}. Like Moon 8 days old, marking seen as on 14th.

16. Like Moon 10 days old, marking nearer equator.

17. Just past transit; in moments of good definition the cottage-loaf is seen with bright spot, but III is nearly round. The shadow of J III in central transit is perfectly round, and about the same size as III itself, but J III is apparently longer in its N. and S. length.

18. Nearly if not quite round; marking and spot probably, but not certainly seen.

19. 7^{h} G.T. Round, no marking or spot seen; good definition.

20. Round.

21. Like Moon 9 days old.

22. Kidney-shaped, but nearly round.

23. Kidney-shaped, N. part very small.

24. Mark and bright spot seen most distinctly before ingress, cottage-loaf appearance quite plain at times; when J III was half on the planet it looked like a close double-star, the stars being in contact, with the smaller component N.f. When one quarter on the disc of Jupiter, it appeared as a gray oblong spot, the longer axis being in 300°–120°, *i.e.* inclined 30° to the belt.

25. 5^{h}. Round, perhaps a dark mark across disc, but uncertain; certainly no bright spot visible.

27. Round, or nearly so.

27. 5^{h}. Perhaps elongated N. and S., no markings or spot seen.

28. $4^{h}\ 45^{m}$. Just out of eclipse, round; no marking or spot visible, definition extraordinarily good.

29. $4^{h}\ 30^{m}$. Round, nothing certainly seen. 6^{h}. Slightly elliptical N. and S., marking appearing at 45°.

30. $4^{h}\ 30^{m}$–$6^{h}\ 20^{m}$. Nearly round, but the mark gives it the usual curious shape. (See sketch.)

May 2. Marking seen, but badly.

4. Round, nothing distinct.

6. Oval like Moon 8 days old, with cusps rounded off, marking at 45° glimpsed.

7. Slightly oval, marking glimpsed ?

10. Round.

11. Round, no distinct marking.

12. Emerging from occultation; when $\frac{1}{4}$ disc was visible, it looked like a close double star; when fully out, the bright spot was glimpsed at 0°, with the dark mark in about 30° N. lat.

13. Spot and mark discernible; N. end of longer axis is tilted towards Jupiter.

14. Like Moon 9 days old, spot and mark on N. limb.

16. $3^{h}\ 50^{m}$ G.T., daylight. Dark marking pretty certainly

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1908. seen; bright spot, perhaps, just visible at N. point of disc. Nearly round, but cut off on f. side; marking difficult.

May 18. Nearly round, if not quite.

31. 5^h. Round.

June 6. J III Tr. In. Round, but bad seeing.

These observations are analysed in the following table, which, roughly summarised, gives—

Age of J III.		
0^d to 1^d	Shape like Moon 11 days old, no spot.	
1 – 2	,, ,, ,, 8 ,, ,,	spot becomes visible.
2 – 3	,, ,, ,, 8 ,, ,,	,, visible.
3 – 4	Cottage-loaf shape,	,, ,,
4 – 5	Nearly round,	spot ceases to be visible.
5 – 7·2	Round,	no spot.

Analysis of the Observations of J III arranged in order of days since last superior geocentric conjunction.

R = round. *r* = nearly round. S = spot seen. *s* = spot perhaps visible. E = elongated. *e* = perhaps elongated. 8, 9, 10, 11 = like moon-shape of 8, 9, 10, 11 days old. : = obsn. doubtful.

Sup. Geo. Conj. 1908.	Age.							
	0·0 days	1·0	2·0	3·0	4·0	5·0	6·0	7·0
Feb. 9·2		8						
23·5	9	8		S 8				
Mar. 1·6				*e*				
8·8	*e*	S 9	S *r*	S R	S R		R	
15·9			S 8	S 8			R	
23·0						*s* *r*	*r*	
30·2	R	9	S 8	*r*	S 11	*s* R		R
Apr. 6·4	11	*r*		8		*s* *e*	*r*	
13·5	*s* 9	8	10	S *r*	*s* : *r*	no S R	R	
20·7	9 :	8 :	8 :	S 8	no S R	*r* :	no S *e*	
27·8	no S R	E	E				R	
May 5·0		8	E			R	R	
12·2	8	S E	S 9		*s* 11		*r*	

London: 1908 *November* 12.

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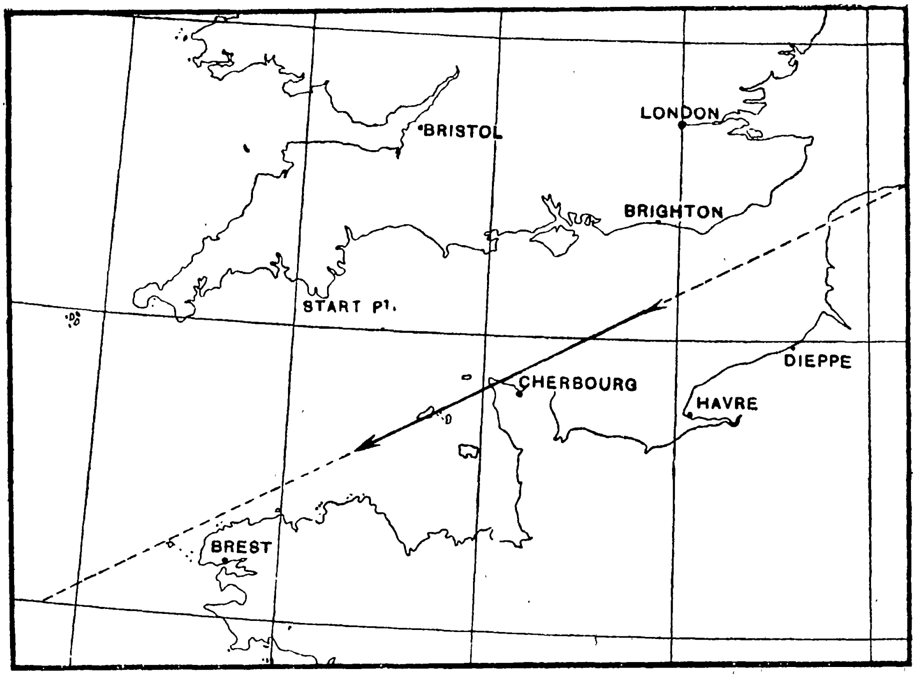
The Fireball of 1909 *February* 22, $7^{h}\ 33^{m}$.

By W. F. Denning.

I have compared the numerous observations of the fireball of February 22 and find that the radiant point best satisfying the observed paths was at 190° + 20°, about 14° E.N.E. of the star β Leonis. This implies that the object had a direction of flight from E.N.E. to W.S.W

It is usually found that a miscellaneous collection of descriptions such as those recently sent in are far from being accordant, but in the present case many of them are in fair agreement, and prove that amateur astronomers are not only increasing in numbers, but that they fully recognise the necessity of recording celestial events with the greatest fulness and accuracy possible.



Fireball of 1909 Feb. 22. Path over English Channel.

Further observations from the French coast and the Channel Islands would be of considerable use as affording a means of testing the exactness of the deductions already made. The meteor gave a magnificent display over the region of Cherbourg, Jersey, and Guernsey, and appears to have illuminated the heavens with more vivid effect than that of full-moon light.